

# Intel<sup>®</sup> Pentium<sup>®</sup> II Processor Performance Brief



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## Intel® Pentium® II Processor Performance Brief

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## EXECUTIVE SUMMARY: INTEL® PENTIUM® II PROCESSOR

The Intel® Pentium® II processor is Intel's proven platform for mainstream business desktops, mobile systems, performance-oriented home PCs, and entry-level servers. It combines the advances of the Intel P6 architecture with the instruction set extensions of Intel MMX™ technology to deliver excellent performance for today's and tomorrow's PC applications.

Additionally, the Pentium II processor delivers great performance for advanced media and communications software, including powerful, realistic graphics and imaging capabilities, video conferencing, and the ability to run full-screen, full-motion video. The combination of these technologies makes the Pentium II processor the ideal choice for executing modern compute-intensive and multimedia-enhanced application workloads, using advanced operating systems.

Today's microprocessors are used to run a broad range of software applications. Multimedia, 3D, and Internet application use has increased sharply over the past few years, and this trend is anticipated to continue in the future. For this reason, a wide range of benchmarks should be considered when evaluating processor and system performance. PC users and buyers should consider the entire Spectrum of Performance, which includes productivity, multimedia, 3D, and Internet performance.

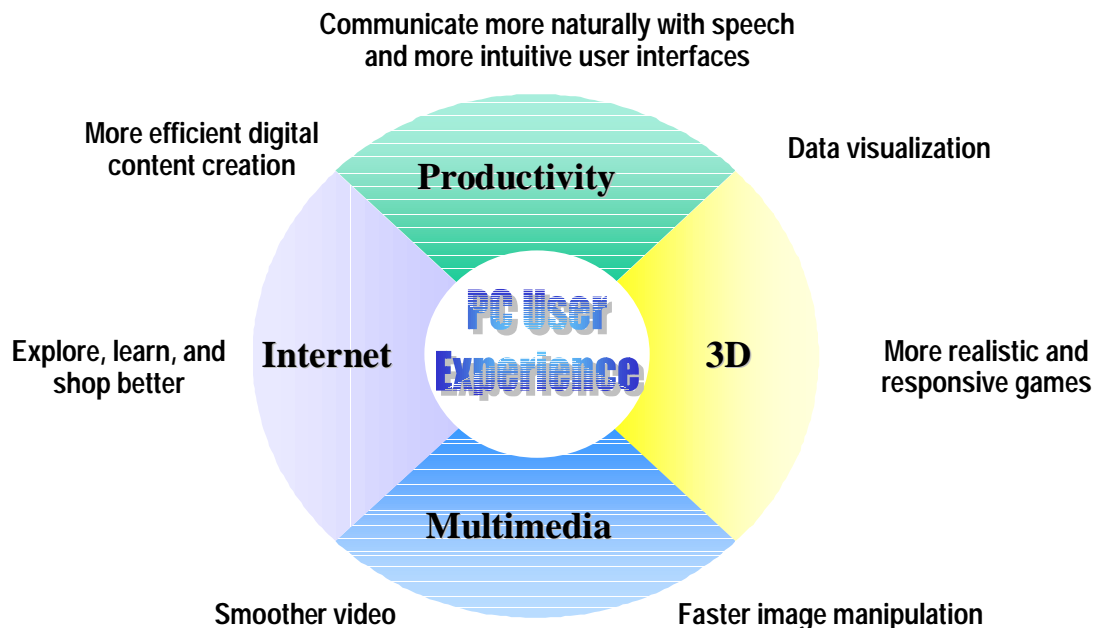


Figure 1. The Spectrum of Performance

This performance brief provides the latest benchmark results for the Intel Pentium II processor across the Spectrum of Performance, explains the technologies that make it work, and examines the purpose and methods behind the industry's most useful benchmarks.



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## INTRODUCTION

The Pentium® II processor delivers outstanding desktop performance today, and provides performance headroom for the advanced applications of tomorrow. It combines the power of the Intel® P6 architecture with the capabilities of Intel MMX™ technology. The latest addition to this processor family is the 450MHz Pentium II processor, which runs with a 100 MHz system bus. Today, the Pentium II processor desktop family contains the following products:

- Pentium® II processor at 450 MHz
- Pentium® II processor at 400 MHz
- Pentium® II processor at 350 MHz
- Pentium® II processor at 333 MHz
- Pentium® II processor at 300 MHz

In any evaluation of performance, it is important to understand how the microprocessor and its host system execute various tasks. Today's PC user runs a broad spectrum of productivity, 3D, multimedia, and Internet software:

- Productivity software includes applications such as word processing, presentation, and personal finance programs
- Multimedia software includes audio, video, imaging, and creativity applications
- 3D software includes gaming, modeling, and simulation applications
- Internet applications include Internet browsers, as well as 3D and multimedia Web content

A processor and system should deliver the highest performance across the entire Spectrum of Performance: Productivity, Multimedia, 3D, and Internet.

This report provides benchmark results for the Intel Pentium II processor family. Modern, industry-standard benchmarks were chosen to demonstrate capabilities across the Spectrum of Performance:

- Productivity performance can be measured using processor-level productivity benchmarks such as Ziff-Davis® CPUmark® 99 and system-level benchmarks such as BAPCO's SYSmark® 98.
- Multimedia performance can be compared with Futuremark's® MultimediaMark® 99 benchmark.
- 3D performance can be measured with the 3D Winbench® 99–3D Lighting and Transformation test, 3DMark® 99 benchmark from Futuremark®, and floating-point benchmarks such as Ziff-Davis' WinBench® 99–FPU WinMark®.
- Java aspects of the Internet experience can be measured by the Ziff-Davis® Jmark® 2.0 Processor Test.

Intel is committed to using the most robust and relevant benchmarks in characterizing the performance of its products, and will adapt this mix over time as newer benchmarks are introduced into the PC market segment.



## **Intel® Pentium® II Processor Performance Brief**

System performance does not depend on the microprocessor alone. Hardware and software system components—such as the operating system, the graphics and I/O subsystems, application software, and memory—may significantly affect benchmark results. For this reason, this Performance Brief illustrates Pentium II processor performance on a consistent system configuration. Details of the system configuration used for the benchmarks throughout this brief can be found in Appendix A.

## SPECTRUM OF PERFORMANCE

When evaluating the performance of a microprocessor or system, it is important to obtain the complete performance picture. A processor and system should deliver high performance across the entire Spectrum of Performance: Productivity, Multimedia, 3D, and Internet.

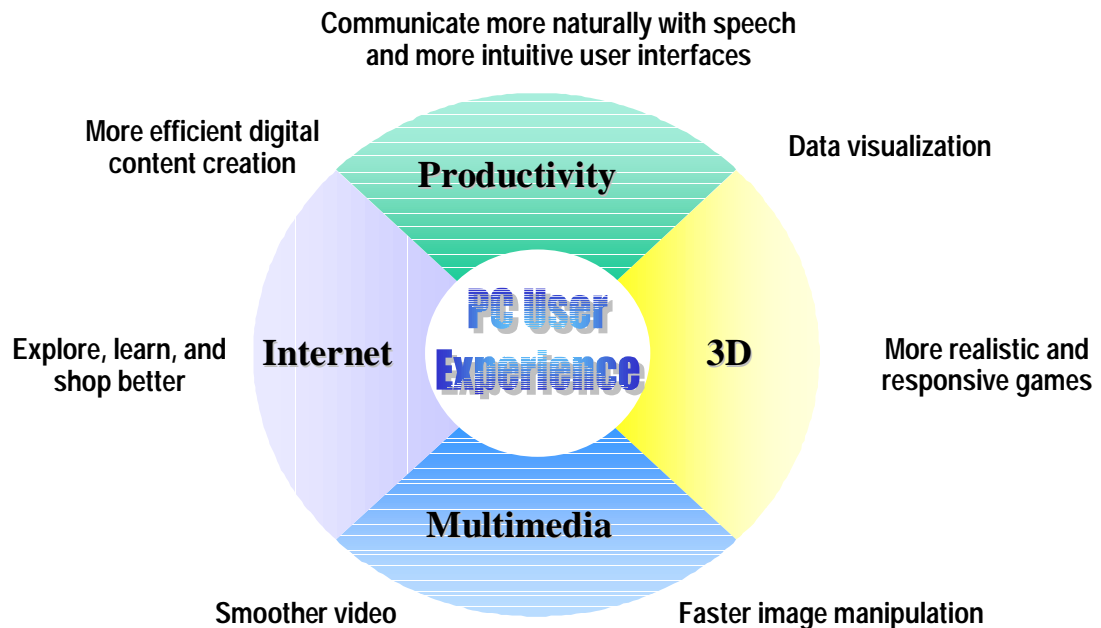


Figure 2. The Spectrum of Performance

### Productivity Benchmarks

Productivity software includes applications such as word processing, presentation, and personal finance. Popular, industry-standard productivity benchmarks include:

#### *Processor Level Benchmarks:*

- CPUmark\* 99
- Wintune\* 98 Advanced CPU Integer Test
- SPECint\*95

#### *System Level Benchmarks:*

- SYSmark\* 98
- High End Winstone\* 99
- Business Winstone\* 99

### Multimedia Benchmarks

Multimedia benchmarks are designed specifically to represent the activities of end users employing video, audio, and imaging technologies such as MPEG1\*, Dolby\* Digital Sound, AVI, PC imaging, and video conferencing. A benchmark that falls under this category is:

- MultimediaMark\* 99





### 3D Benchmarks/Floating-Point Benchmarks

The most common type of 3D application today is 3D games. Benchmarks that measure processor 3D, and floating point performance include:

- 3D Winbench\* 99–3D Lighting and Transformation Test
- Futuremark\* 3Dmark\* 99 CPU Processing Speed Test
- WinBench\* 99–FPU WinMark\*
- SPECfp\*95

### Internet Technology Benchmarks

Internet applications are evolving at a tremendous rate and include browser, 3D, and multimedia technologies. In attempting to evaluate processor Internet performance, PC users should consult the productivity, 3D, and multimedia benchmarks listed above. Additionally, some Java Internet technology benchmarks are:

#### *Processor Level Benchmarks:*

- Jmark\* 2.0 Processor Test

#### *System Level Benchmarks:*

- SYSmark\* J



## THE INTEL® PENTIUM® II PROCESSOR

The Intel® Pentium® II processor is Intel's proven platform for mainstream business desktops, mobile systems, performance-oriented home PCs, and entry-level servers. It combines the advances of the Intel P6 architecture with the instruction set extensions of Intel MMX™ technology to deliver excellent performance for today's and tomorrow's PC applications.

The Pentium II processor offers exceptional performance for advanced media, communications, and Internet software, including powerful, realistic graphics and imaging capabilities, video conferencing, and the ability to run full-screen, full-motion video. The combination of these advanced technologies make the Pentium II processor a great choice for executing modern compute-intensive and multimedia-enhanced application workloads using advanced operating systems. The Pentium II processor also makes an outstanding choice for high performance on mainstream office productivity applications.

Based on Intel's advanced 0.25 micron CMOS process technology, the processor core has approximately 7.5 million transistors. Available in desktop, workstation, server, and mobile systems, at clock speeds from 300MHz to 450MHz, the Pentium II processor also incorporates advanced features such as Dual Independent Bus architecture, a dedicated level 2 cache, Dynamic Execution, available error correction code, and scalability to dual-processing systems.

Pentium II processors for desktop systems, workstations, and servers are available in Intel's Single Edge Contact (S.E.C.) Cartridge for high-volume availability, improved handling protection, and compatibility with widely deployed platforms.

The Pentium II processor is backed by over 25 years of Intel experience in manufacturing high-quality, reliable microprocessors.

## INTEL® PENTIUM® II PROCESSOR PRODUCT FEATURE HIGHLIGHTS

The Pentium II processor is fully compatible with an entire library of PC software based on operating systems such as MS-DOS\*, Windows\* 3.1, Windows for Workgroups\* 3.11, Windows 98, Windows 95, OS/2\*, UnixWare\*, SCO UNIX\*, Windows NT, OPENSTEP\*, and Sun Solaris\*. Architectural features of the Pentium II processor include:

- Dynamic Execution Technology:
  - ⇒ Dynamic execution incorporates the concepts of out-of-order and speculative execution. The Pentium® II processor's implementation of these concepts removes the constraint of linear instruction sequencing between the traditional fetch and execute phases of instruction execution. Up to 3 instructions can be decoded per clock cycle. These decoded instructions are put into a buffer, which can hold up to 40 instructions. Instructions are executed from this buffer when their operands are available (versus instruction order). Up to 4 instructions can be executed per clock cycle.



## Intel® Pentium® II Processor Performance Brief

- Superpipelining:
  - ⇒ The pipeline of the P6 processor family consists of approximately 12 stages, versus 5 for the Pentium® processor and 6 for the Pentium processor with MMX™ technology. This enables the Pentium II processor to achieve about a 50% higher frequency than the Pentium processor on the same manufacturing technology. The sophisticated, two-level, adaptive-training, branch prediction mechanism of the Pentium II processor is key to maintaining the efficiency of the superpipelined microarchitecture.
- Dual Independent Bus (DIB) Architecture:
  - ⇒ This architecture consists of two distinct buses emanating from the Pentium® II processor: the L2 cache bus and the system bus (used for memory and I/O requests). The L2 cache bus speed scales with processor frequency. For the Pentium II processor at 266 MHz, the L2 cache bus operates at 133 MHz, which is twice the speed of Pentium processor systems. The system bus for both processors runs at 66 MHz. The net result is that the Pentium II processor at 266 MHz has about 3 times the peak bus bandwidth of the highest speed Pentium processor system, which has but one bus running at a peak of 66 MHz. Also, since speed of L2 cache accesses is one of the more important system factors in determining overall performance, system performance will scale well with higher processor frequencies. Unlike the Pentium processor's system bus, the Pentium II processor's system bus supports up to 8 outstanding bus requests (4 per processor). This allows more parallelism between processors and I/O, as well as supporting smooth performance scaling to a 2 processor system. The GTL+ electrical signaling of the system bus facilitates the migration of this bus to higher frequencies as higher performance DRAM technologies come to market.
- High Performance Intel MMX™ Technology:
  - ⇒ Intel's MMX™ media enhancement technology is a major extension of the Intel Architecture that makes PCs into richer multimedia and communications platforms. This technology introduces 57 instructions oriented to highly parallel operations with multimedia and communications data types. These instructions use a technique known as SIMD (Single Instruction, Multiple Data) to deliver better performance for multimedia and communications computation. Intel processors that provide MMX technology support are fully compatible with previous generations of the Intel Architecture and the installed base of software.
  - ⇒ To further improve performance, the Pentium® II processor, like the Pentium processor with MMX™ technology, can execute 2 Intel MMX instructions at a time.
- Write Combining:
  - ⇒ The Write Combining technology of the P6 architecture can be used to achieve very high graphics I/O performance. This feature combines multiple writes to a region of memory (for example, a video controller's frame buffer) declared as WC type into a single-burst write operation. This is well suited for the bus, which is optimized for burst transfers. The combining also leads to burst writes of cache line sizes. These writes are further combined by the chipset, leading to high throughput for graphics I/O. The result is enhanced multimedia performance, more realistic full-motion video, and realistic, fast graphics performance.



## Intel® Pentium® II Processor Performance Brief

- Caches:
  - ⇒ The Pentium® II processor has 32 KB of non-blocking L1 cache, which is divided into a 16K instruction cache and a 16K data cache. Each of these caches runs at the processor frequency and provides fast access to heavily used data.
  - ⇒ The Pentium® II processor has a 512K L2 cache which is unified for code and data, and is non-blocking. There is a dedicated 64-bit bus to facilitate higher data transfer rates between the processor and the L2 cache.
- The floating-point pipeline supports the 32-bit and 64-bit IEEE 754 formats as well as the 80-bit format. The FPU is object code-compatible with the Pentium® and i486™ processor FPUs.
- The GTL+ bus provides glueless support for two processors, giving a cost-effective SMP solution. This can be used to significantly enhance OS and application performance in multithreaded or multitasking environments or for functional redundancy checking.
- Testing and Performance Monitoring Features:
  - ⇒ Built In Self Test (BIST) provides single stuck-at fault coverage of the microcode and large PLAs, as well as testing of the instruction cache, data cache, Translation Lookaside Buffers (TLBs), and ROMs.
  - ⇒ IEEE\* 1149.1 Standard Test Access Port and Boundary Scan Architecture mechanism allows testing of the Pentium® II processor through a standard interface.
  - ⇒ Internal performance counters can be used for performance monitoring and event counting.



## iCOMP® INDEX 3.0

The iCOMP® Index provides a simple, relative measure of microprocessor performance. It is not a benchmark, but a collection of benchmarks used to calculate an index of relative performance that can help PC purchasers decide which Intel microprocessor best meets their computing needs. The iCOMP Index 3.0 comprehends:

1. **Development of new or updated benchmarks.** The PC industry updates existing benchmarks, or develops new benchmarks, to reflect the unique mix of instructions for existing and emerging software.
2. **Increasing use of 3D, multimedia, and Internet technology and software.** Another trend incorporated into the new formula is the increasing use of 3D, multimedia, and Internet technology and software.

The iCOMP Index 3.0 rating is based on the Spectrum of Performance. A higher iCOMP rating indicates higher relative performance of an Intel microprocessor.

Figure 3 illustrates the iCOMP Index 3.0 ratings for Intel's highest performing desktop microprocessors. System configurations used in iCOMP Index 3.0 measurements are listed in Appendix B.

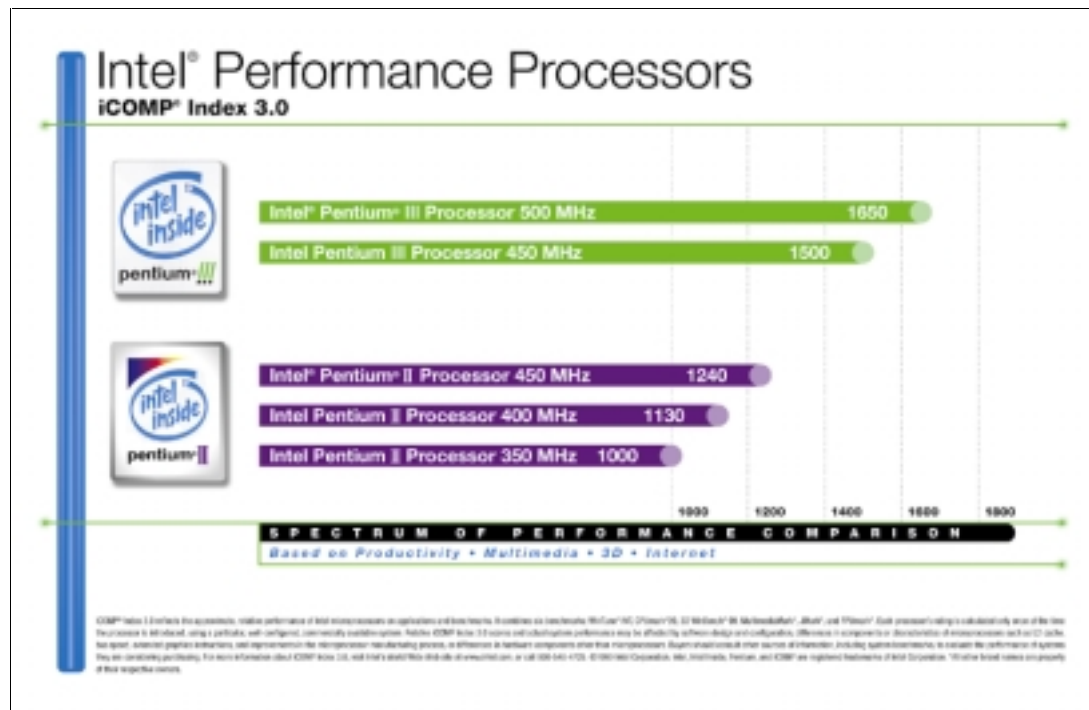


Figure 3. iCOMP® Index 3.0 Ratings for Pentium® III Processors and Pentium II Processors (System configuration for iCOMP Index 3.0 components is given in Appendix B)

Please see the next page for important information about the iCOMP Index 3.0



## Intel® Pentium® II Processor Performance Brief

The Pentium II processor 333MHz scores 940 on the iCOMP Index 3.0, and the Pentium II processor 300MHz scores 860. These ratings are not shown in Figure 3. See Appendix B for a complete list of iCOMP Index 3.0 ratings for Pentium II processors.

iCOMP Index 3.0 reflects the approximate, relative performance of Intel microprocessors on applications and benchmarks. It combines six benchmarks: Wintune\* 98 Advanced CPU Integer test, CPUmark\* 99, 3D WinBench\* 99–CPU Lighting and Transformation test, MultimediaMark\* 99, Jmark\* 2.0 Processor Test, and WinBench\* 99–FPU WinMark\*.

Each processor's rating is calculated only once at the time the processor is introduced, using a particular, well-configured, commercially available system. Relative iCOMP® Index 3.0 scores and actual system performance may be affected by software design and configuration, differences in components or characteristics of microprocessors such as L2 cache, bus speed, extended graphics instructions, and improvements in the microprocessor manufacturing process, or differences in hardware components other than microprocessors.

Buyers should consult other sources of information, including system benchmarks, to evaluate the performance of systems they are considering purchasing. For more information about iCOMP Index 3.0, visit Intel's World Wide Web site at [www.intel.com](http://www.intel.com), or call 800-548-4725.



## MICROPROCESSOR PERFORMANCE SUMMARY

### Productivity Benchmarks

#### CPUMark\* 99

Ziff-Davis' CPUMark\* 99 is a Windows\* benchmark that measures the performance of a PC processor, its internal cache (both level one and/or level two), external cache, and system RAM.

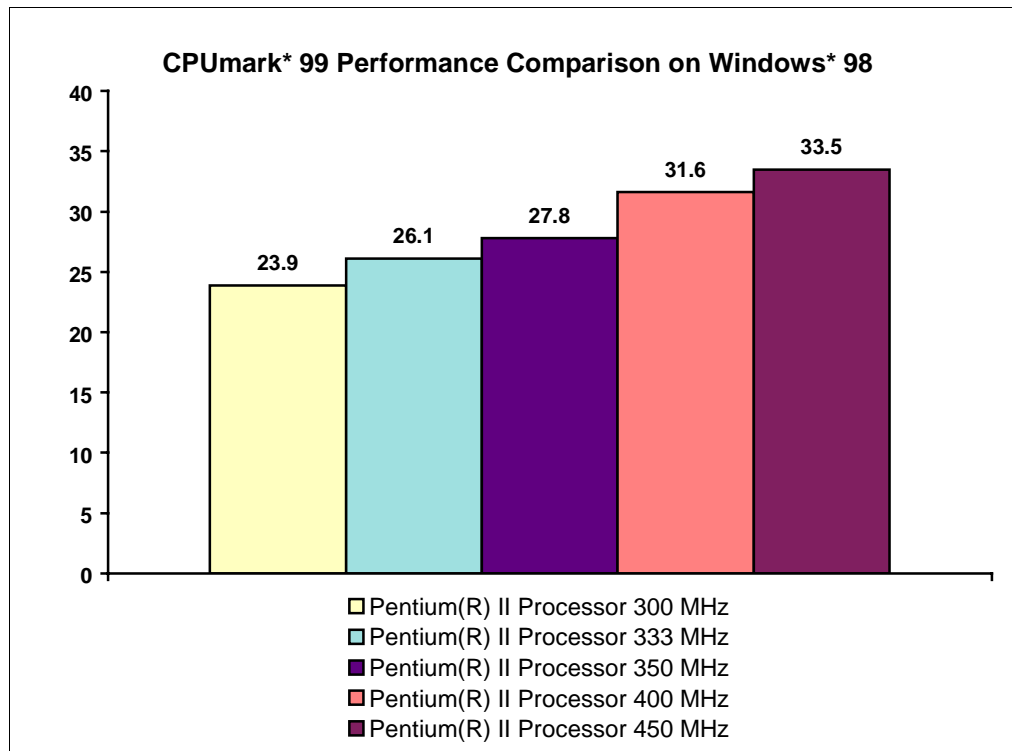


Figure 4. Intel® Pentium® II Processor Performance for the Ziff-Davis\* CPUMark\* 99 Benchmark



### Wintune\* 98 Advanced CPU Integer Test

Wintune\* 98 is a diagnostic testing and benchmark program for Windows 98, Windows 95 and Windows NT systems. It performs a series of seven tests, including CPU, memory, video, and disk speed tests. Test results can be compared to results from similar machines through a central database maintained by Windows Magazine on the Internet.

The Wintune 98 Advanced CPU Integer test concentrates on the productivity performance of the CPU. In addition, this test stresses the CPU memory cache to reflect the performance of real world applications. Results of this test are most applicable to word processing, spreadsheet, and other productivity applications.

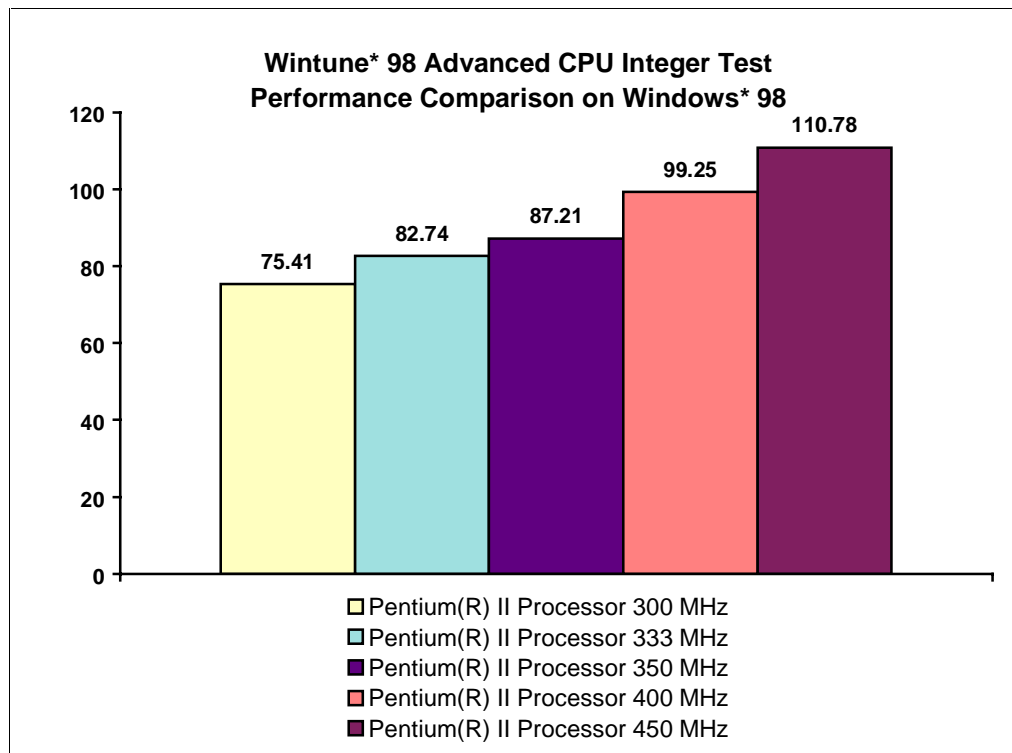


Figure 5. Intel® Pentium® II Processor Performance for the Wintune\* 98 Advanced CPU Integer Test





## SPECint95

SPEC CPU95\* is a software benchmark product that can be run on Windows\* NT and many varieties of UNIX\*. SPEC CPU95 is produced by Standard Performance Evaluation Corp. (SPEC), a non-profit group of computer vendors, system integrators, universities, research organizations, publishers, and consultants throughout the world. It was designed to provide comparisons of performance for compute-intensive workloads on different computer systems.

SPEC CPU95 consists of two suites of benchmarks: SPECint95 for measuring and comparing compute-intensive integer performance, and SPECfp95\* for measuring and comparing compute-intensive floating-point performance. The two suites provide component-level benchmarks that measure the performance of the computer's processor, memory architecture, and compiler. SPEC benchmarks are selected from existing application and benchmark source code running across multiple platforms.

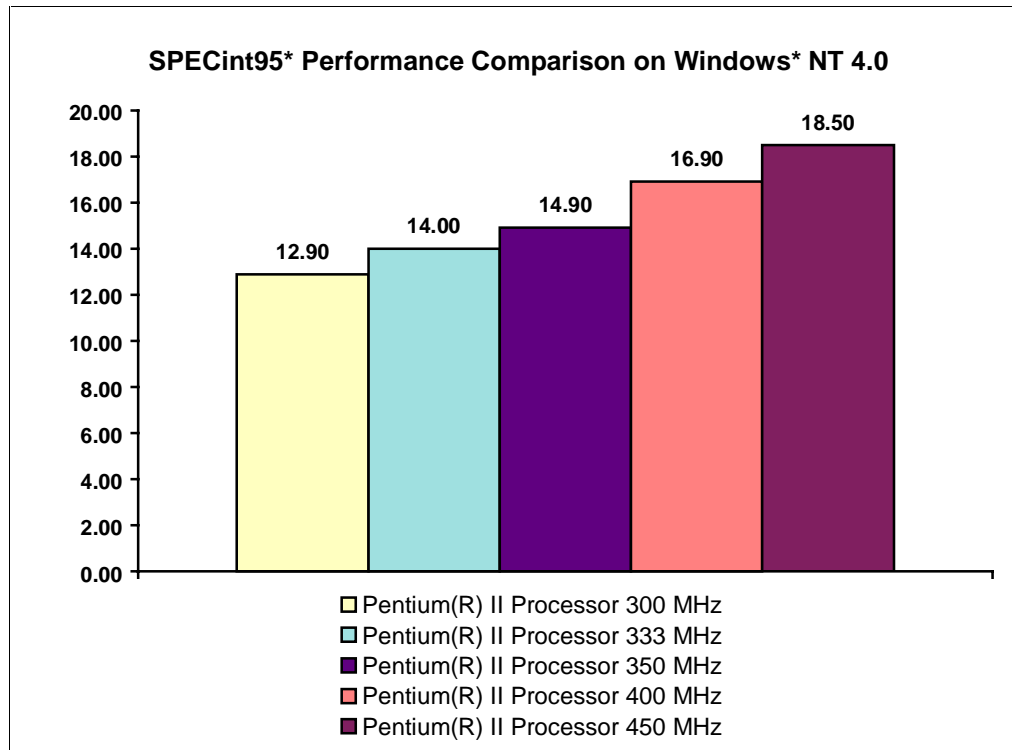


Figure 6. Intel® Pentium® II Processor Performance for the SPECint95\* Benchmark



### **SYSmark® 98 For Windows® 98 and NT 4.0**

SYSmark® 98 for Windows® 98 and Windows NT 4.0 is a suite of application software and associated benchmark scripts developed by Business Applications Performance Corporation (BAPCO), a non-profit consortium of PC OEMs, software vendors, semiconductor manufacturers, and industry publications. SYSmark 98 is a tool that measures system performance on popular business-oriented applications in the Microsoft® Windows operating environment. The scripts were developed to reflect usage patterns of PC users in a business-oriented environment.

SYSmark 98 includes 32-bit benchmark scripts for the following categories and applications:

Office Productivity:

- Corel® CorelDRAW® 8
- Microsoft Excel® 97
- Dragon Systems® Naturally Speaking® 2.02
- Netscape® Communicator® 4.05
- Caere® OmniPage Pro® 8.0
- Corel Paradox® 8.0
- Microsoft PowerPoint® 97
- Microsoft Word® 97

Content Creation:

- MetaCreations® Bryce® 2
- Avid® Elastic Reality® 3.1
- Macromedia® Extreme3D® 2
- Adobe® Photoshop® 4.0.1
- Adobe Premiere® 4.2
- Xing Technology® XingMPEG® Encoder® 2.1

Figure 7 and Figure 8 illustrate the SYSmark 98 rating under Windows 98 and Windows NT 4.0 for the Pentium® II processor.

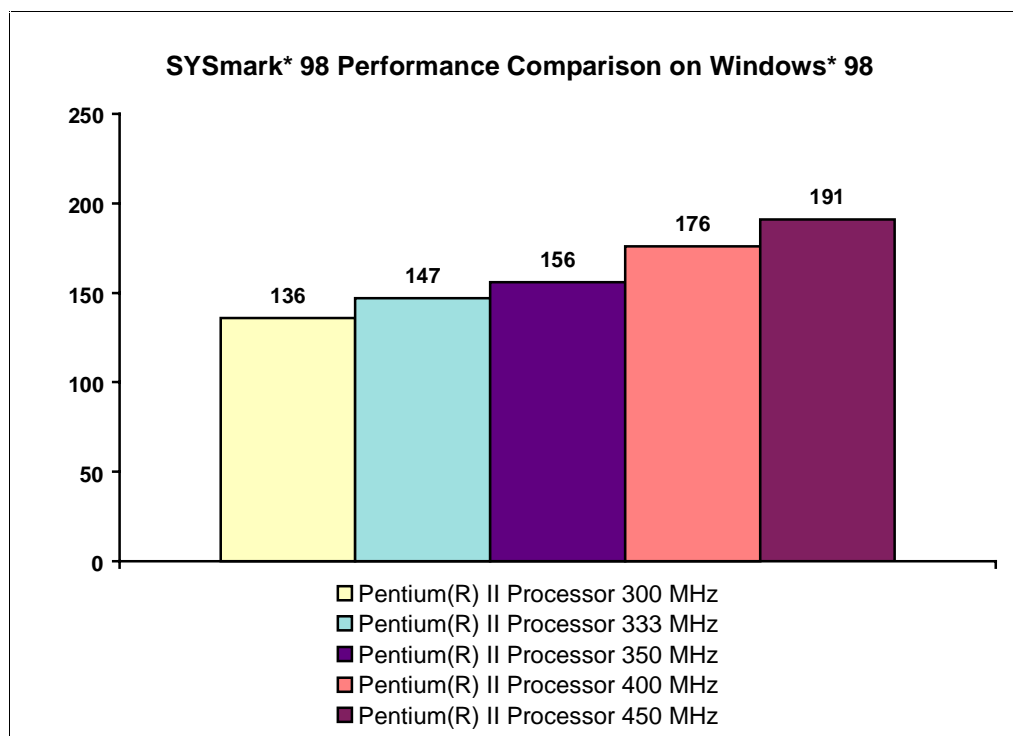


Figure 7. Intel® Pentium® II Processor Performance for SYSmark® 98 on Windows® 98

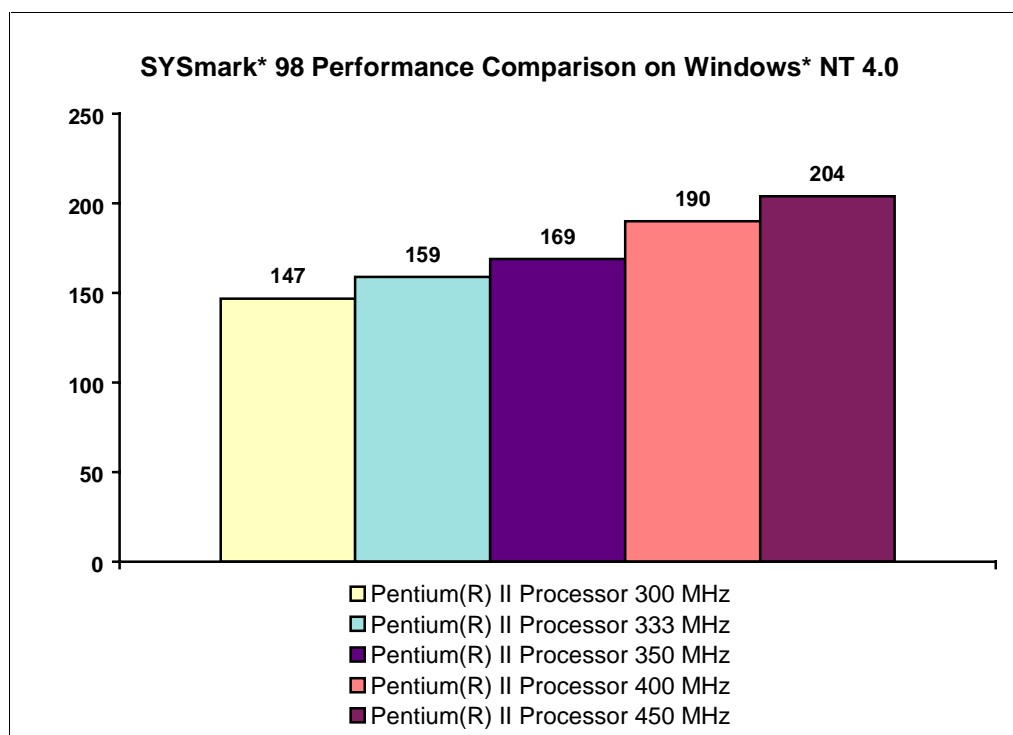


Figure 8. Intel® Pentium® II Processor Performance for SYSmark® 98 on Windows® NT 4.0



## Winstone\* 99

Winstone\* 99 is a system-level, application-based benchmark developed by Ziff-Davis\*. Winstone 99 measures a PC's overall performance when running Windows\*-based 32-bit applications on Windows 98 or Windows NT 4.0. It runs actual 32-bit business suites through a series of scripted activities and uses the time a PC takes to complete those activities to produce its performance scores.

Winstone 99 incorporates the following popular office software suites: Corel WordPerfect\* Suite 8, Lotus\* SmartSuite\*, and Microsoft Office\* 97. To mirror the typical usage patterns of today's PC users, the benchmark keeps multiple applications open within each suite, and switches tasks between these applications and the Netscape Navigator\* Internet browser.

Unlike Business Winstone 99, the applications in High End Winstone 99 are not grouped into suites. This benchmark includes the following applications: Adobe Photoshop\* 4, Adobe Premiere\* 4.2, AVS/Express\* 3.4, Microsoft FrontPage\* 98, Microsoft\* Visual C++ 5.0, Sound Forge\* 4.0 and MicroStation\* SE.

Figure 9 and Figure 10 illustrate the results for High End Winstone 99 for Windows NT 4.0 and Business Winstone 99 for Windows 98, respectively.

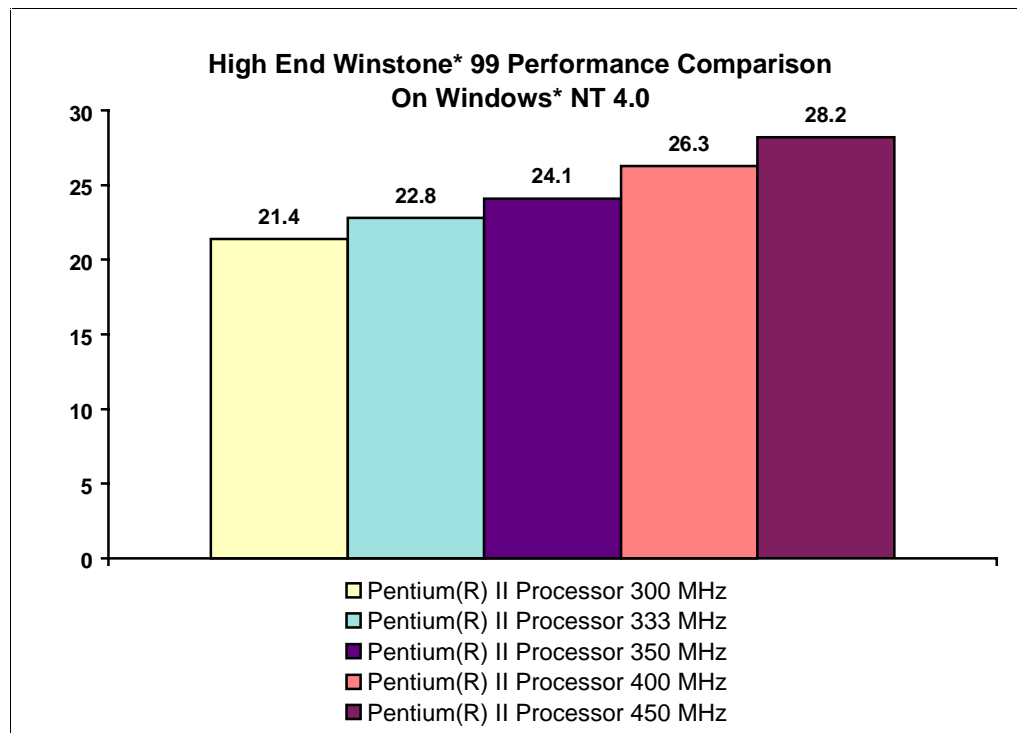


Figure 9. Intel® Pentium® II Processor Performance for the High End Winstone\* 99 Benchmark



## Intel® Pentium® II Processor Performance Brief

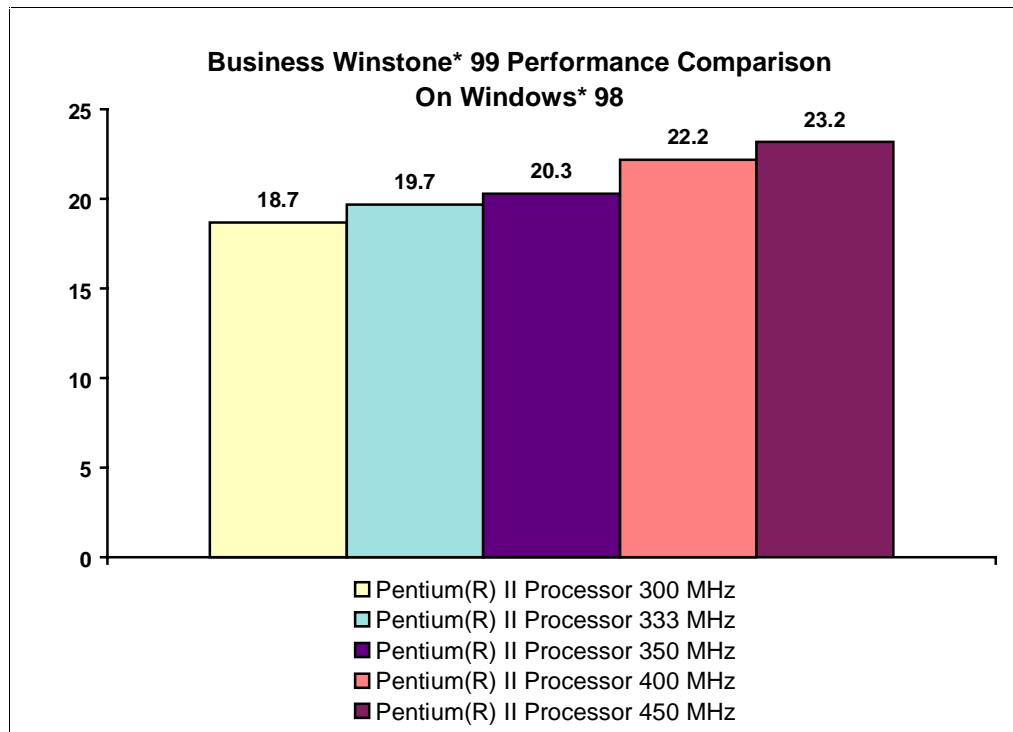


Figure 10. Intel® Pentium® II Processor Performance for the Business Winstone\* 99 Benchmark

## Multimedia Benchmarks

### MultimediaMark\* 99

MultimediaMark\* 99 is a benchmark application suite by Futuremark Corporation. It focuses on testing multimedia performance of a modern PC in a “real world” environment. The components of MultimediaMark 99 include MPEG-1\* video encoding, MPEG-1 video playback, image processing, and audio effects.

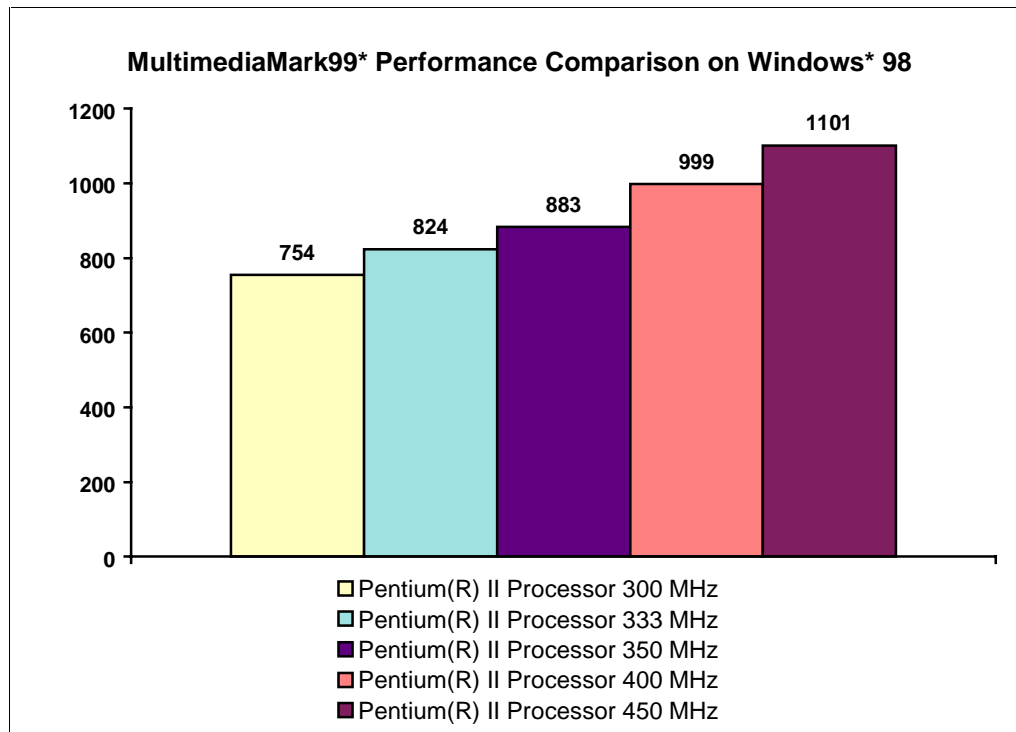


Figure 11. Intel® Pentium® II Processor Performance for the MultimediaMark\* 99 Benchmark

## 3D Benchmarks/Floating-Point Benchmarks

### 3D Winbench\* 99–3D Lighting and Transformation Test

3D Winbench\* 99 measures system-level 3D performance including CPU and graphics subsystem performance. To understand the processor's 3D performance, the benchmark suite includes the 3D WinBench 99–3D Lighting and Transformation test. This benchmark measures the CPU intensive portion of the 3D graphics pipeline.

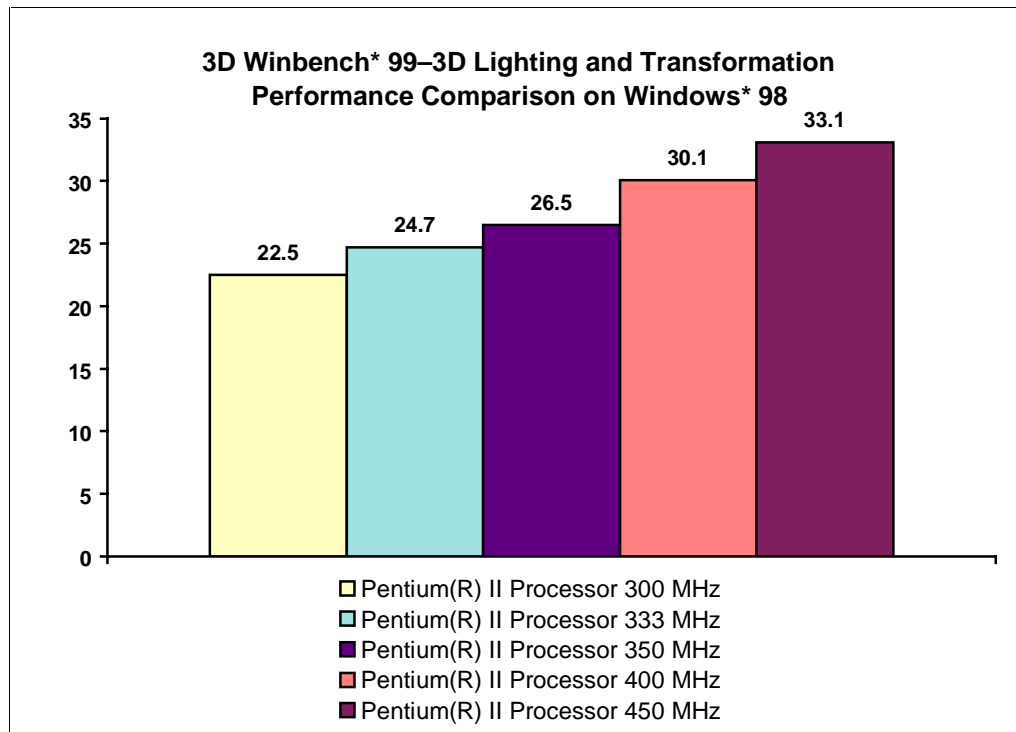


Figure 12. Intel® Pentium® II Processor Performance for the 3D Winbench\* 99–3D Lighting and Transformation Test

### 3DMark\* 99–CPU Geometry Speed Test

3DMark\* 99 from Futuremark is a diagnostic suite of benchmarks, based on current 3D games and high end applications, that analyzes, tests, and reports on a system's 3D performance. For processor comparisons, 3DMark 99 includes the CPU Geometry Speed test. This test focuses on the floating-point intensive 3D-geometry portion of the graphics pipeline.

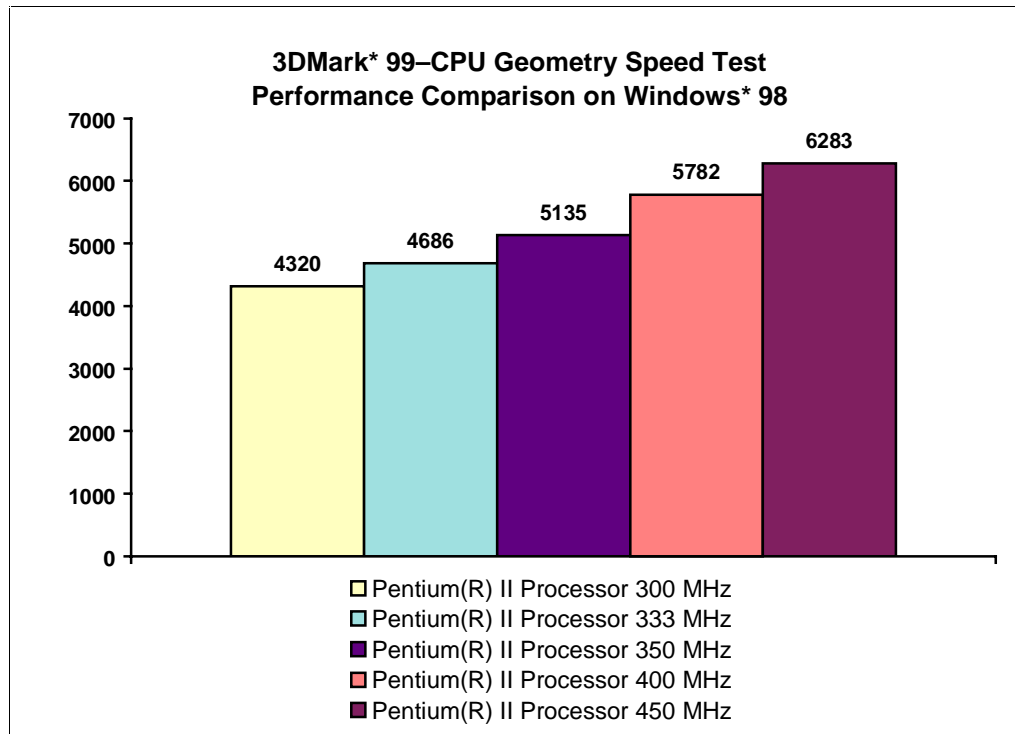


Figure 13. Intel® Pentium® II Processor Performance for the 3DMark\* 99 CPU Geometry Speed Test



## WinBench\* 99–FPU WinMark\*

The WinBench\* 99–FPU WinMark\* benchmark measures the performance of the processor's floating-point subsystem, which is used for such tasks as 3D graphics rendering and scientific calculations. This synthetic benchmark was developed by Ziff-Davis\*. The test consists of five algorithms: 3D graphics operations, fast Fourier transforms (FFT), calculation of planetary orbitals, calculation of areas of polygons, and Gauss-Jordan elimination of a coefficient matrix of linear equations. The benchmark reports a single score based on the weightings that Ziff-Davis has assigned to the component algorithms.

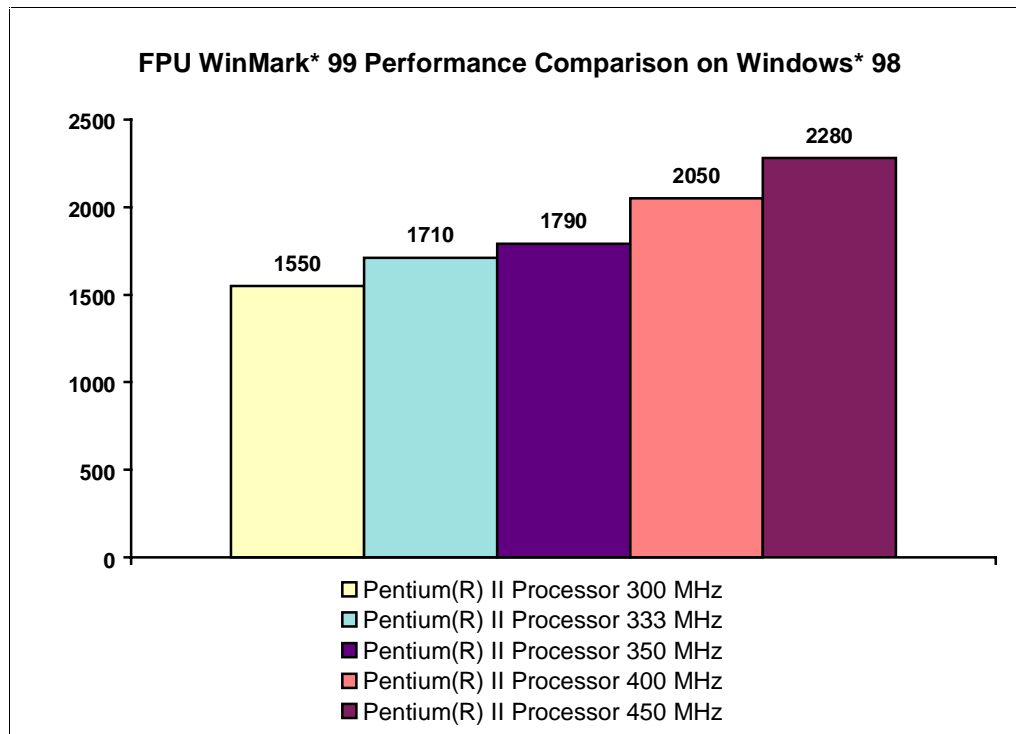


Figure 14. Intel® Pentium® II Processor Performance for the WinBench\* 99–FPU WinMark\* Benchmark



## SPECfp\*95

SPEC CPU95\* is a software benchmark product that can be run on Windows\* NT and many varieties of UNIX\*. SPEC CPU95 is produced by the Standard Performance Evaluation Corp. (SPEC), a non-profit group of computer vendors, system integrators, universities, research organizations, publishers, and consultants throughout the world. It was designed to provide measures of performance for comparing compute-intensive workloads on different computer systems.

SPEC CPU95 consists of two suites of benchmarks: SPECint95\* for measuring and comparing compute-intensive integer performance, and SPECfp95 for measuring and comparing compute-intensive floating-point performance. The two suites provide component-level benchmarks that measure the performance of the computer's processor, memory architecture, and compiler. SPEC benchmarks are selected from existing application and benchmark source code running across multiple platforms.

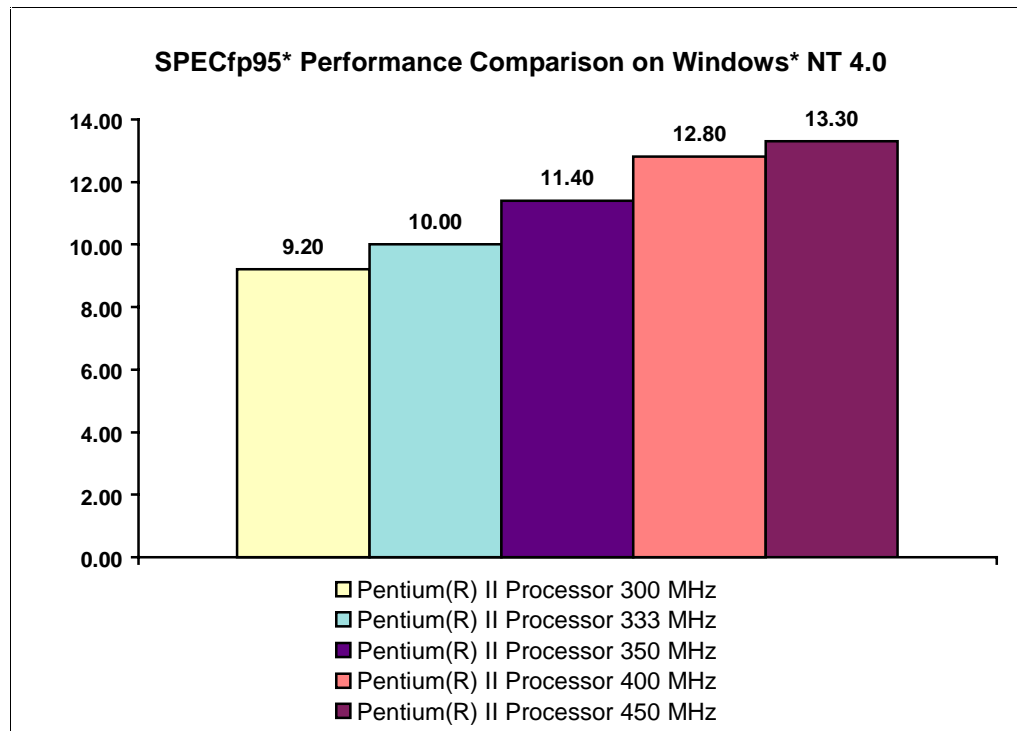


Figure 15. Intel® Pentium® II Processor Performance for the SPECfp95\* Benchmark



## Internet Technology Benchmarks

### JMark\* 2.0 Processor Test

Jmark\* 2.0 is a benchmark developed by Ziff-Davis\* to measure processor Java performance. The Jmark\* 2.0 Processor Test stresses the Java Virtual Machine (JVM) on a non-graphical workload.

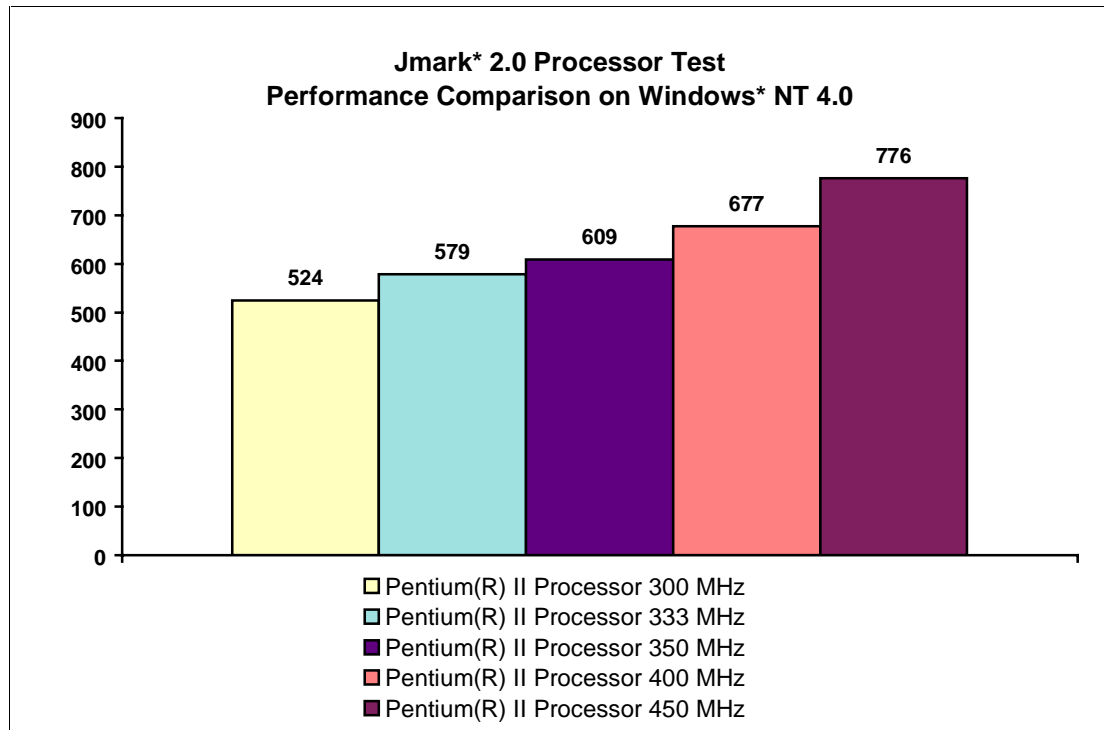


Figure 16. Intel® Pentium® II Processor Performance for the Ziff-Davis\* Jmark\* 2.0 Processor Test



## SYSmark\* J

SYSmark\* J is a Java benchmark suite designed and developed by the Business Applications Performance Corporation (BAPCO). It allows performance comparisons across platforms that support Java Development Kit Version 1.1 (JDK1.1). SYSmark J is a collection of 4 applications covering word processing, spreadsheet, image processing, and multimedia.

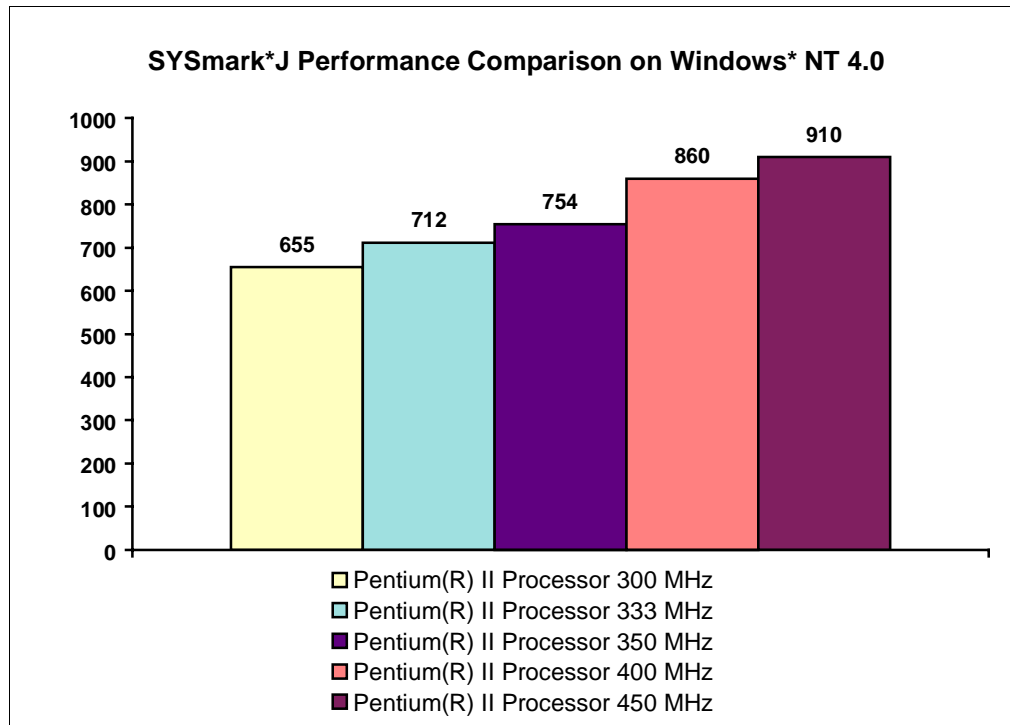


Figure 17. Intel® Pentium® II Processor Performance for SYSmark\* J for Windows\* 98



## Intel® Pentium® II Processor Performance Brief

### SUMMARY

Table 1 summarizes the iCOMP Index 3.0 performance for the Intel® Pentium® II processor. A higher score indicates better performance.)

**Table 1. iCOMP® Index 3.0 Results**

Pentium® II Processor 450MHz	Pentium® II Processor 400MHz	Pentium® II Processor 350MHz	Pentium® II Processor 333MHz	Pentium® II Processor 300MHz
1240	1130	1000	940	860

Table 2 summarizes productivity benchmark performance for the Intel Pentium II processor. A higher score indicates better performance.

**Table 2. Spectrum of Performance Benchmark Results—Productivity Benchmarks**

	Pentium® II Processor 450MHz	Pentium® II Processor 400MHz	Pentium® II Processor 350MHz	Pentium® II Processor 333MHz	Pentium® II Processor 300MHz
<b>SYSmk*98—Win98*</b>	191	176	156	147	136
<b>Business Winstone* 99—Win98*</b>	23.2	22.2	20.3	19.7	18.7
<b>SYSmk* 98—NT 4.0</b>	204	190	169	159	147
<b>Business Winstone* 99—NT 4.0</b>	31.4	29.9	27.5	26.5	24.9
<b>High End Winstone* 99—NT 4.0</b>	28.2	26.3	24.1	22.8	21.4
<b>CPUmark* 99—Win98*</b>	33.5	31.6	27.8	26.1	23.9
<b>Wintune* 98 Advanced CPU Integer Test—Win98*</b>	110.78	99.25	87.21	82.74	75.41
<b>SPECint*95—NT 4.0</b>	18.50	16.90	14.90	14.00	12.90

Table 3 summarizes multimedia benchmark performance for the Intel Pentium II processor. A higher score indicates better performance.

**Table 3. Spectrum of Performance Benchmark Results—Multimedia Benchmarks**

	Pentium® II Processor 450MHz	Pentium® II Processor 400MHz	Pentium® II Processor 350MHz	Pentium® II Processor 333MHz	Pentium® II Processor 300MHz
<b>MultimediaMark* 99—Win98*</b>	1101	999	883	824	754



## Intel® Pentium® II Processor Performance Brief

Table 4 summarizes 3D/floating point benchmark performance for the Intel® Pentium® II processor. A higher score indicates better performance.

**Table 4. Spectrum of Performance Benchmark Results—3D Benchmarks/Floating-Point Benchmarks**

	Pentium® II Processor 450MHz	Pentium® II Processor 400MHz	Pentium® II Processor 350MHz	Pentium® II Processor 333MHz	Pentium® II Processor 300MHz
3D WB99/3D* Processing (Lighting & Transformation)— Win98*	33.1	30.1	26.5	24.7	22.5
WinBench* 99—FPU WinMark*— Win98*	2280	2050	1790	1710	1550
3Dmark* 99 CPU Geometry Speed—Win98*	6283	5782	5135	4686	4320
SPECfp95*_base95—NT 4.0	11.90	11.50	10.30	9.07	8.32
SPECfp95*—NT 4.0	13.30	12.80	11.40	10.00	9.20

Table 5 summarizes Internet benchmark performance for the Intel Pentium II processor. A higher score indicates better performance.

**Table 5. Spectrum of Performance Benchmark Results—Internet Technology Benchmarks**

	Pentium® II Processor 450MHz	Pentium® II Processor 400MHz	Pentium® II Processor 350MHz	Pentium® II Processor 333MHz	Pentium® II Processor 300MHz
Jmark* 2.0 Processor Test—NT 4.0	776	677	609	579	524
SYSmark* J—NT 4.0	910	860	754	712	655



## APPENDIX A — TEST CONFIGURATIONS

**Table 6. System Configuration Used in Benchmark Tests**

Processor	<b>Pentium® II Processor 450MHz, 400MHz, 350MHz, 333MHz, 300MHz</b>
System	Intel® SE440BX-2 motherboard
FPU	Integrated
Secondary Cache	512KB
Memory Size	128 MB SDRAM 100MHz
Hard Disk Controller/Bus	Adaptec® AHA2940U2W SCSI/PCI
Hard Disk	Seagate Cheetah® ST39102LW
Video Controller/Bus	Diamond® Multimedia Viper® V550 AGP
Video Memory Size/Type	16MB SGRAM
<b>Operating System 1</b>	<b>Windows® 98 - Build 1998</b>
Video Driver Revision	4.10.01.0239
Graphics	1024x768 Resolution, 16bit Color
<b>Operating System 2</b>	<b>Windows® NT 4.0 - Build 1381 w/service pack 4</b>
Video Driver Revision	4.00.1381.203, 4.00
Graphics	1024x768 Resolution, 16 bit color
CD ROM Drive	Toshiba® 32X XM-6201B SCSI
Sound Card	Diamond MonsterSound® M80 PCI
C Compiler	Intel C/C++* Compiler Plug-in V4.0 Microsoft® Visual C/C++ 6.0 (for libraries)
FORTRAN Compiler	Intel FORTRAN Compiler Plug-in V2.4
Browser	Internet Explorer® V4.72.3110 Updated With SP1,3283



## APPENDIX B — iCOMP® INDEX CONFIGURATION

Table 7. System Configuration Used for iCOMP Index 3.0 Ratings

Processor	Pentium® II Processor 450MHz, 400MHz, 350MHz, 333MHz, 300MHz
FPU	Integrated
System	Intel® SE440BX-2
Secondary Cache	512KB
Hard Disk	Adaptec* AHA2940U2W SCSI/PCI, Seagate Cheetah* ST39102LW
Video	Diamond* Multimedia Viper V550 AGP (w/ 16MB SDRAM); Driver: 4.10.01.0239
Audio	Diamond* MonsterSound M80 PCI
Operating System	Windows*98 with Microsoft DirectX* 6.1
Memory Size	128 MB SDRAM
Graphics	1024x768 Resolution, 16-bit color

## iCOMP® Index 3.0 Component Scores As Measured On Appendix B Configurations

Table 8. iCOMP Index 3.0 Component scores on Appendix B Configurations

Processor (All on Windows 98)	Pentium® II Processor 450 MHz	Pentium® II Processor 400 MHz	Pentium® II Processor 350 MHz	Pentium® II Processor 333 MHz	Pentium® II Processor 300 MHz
iCOMP® Index 3.0 Rating	1240	1130	1000	940	860
Wintune*98 Advanced CPU Integer Test	110.78	99.25	87.21	82.74	75.41
CPUmark* 99	33.5	31.6	27.8	26.1	23.9
MultimediaMark* 99	1101	999	883	824	754
FPU WinMark*99	2280	2050	1790	1710	1550
3D WB*99 Lighting & Transformation	33.1	30.1	26.5	24.7	22.5
Jmark* 2.0 Processor Test	751	674	605	561	531